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Headquarters U.S. Air Force

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Tri-Service Enhanced Bioremediation Guidance Manual

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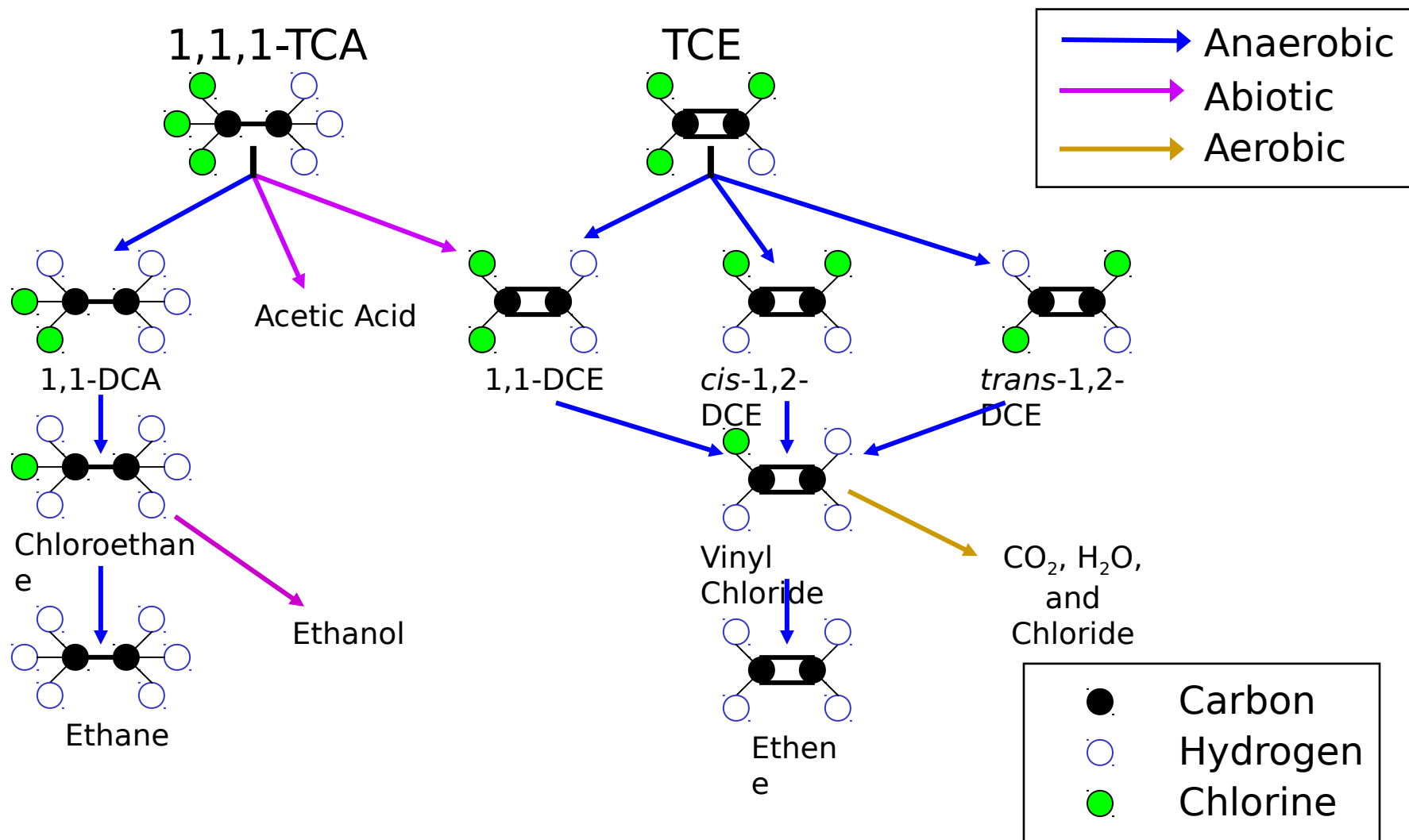
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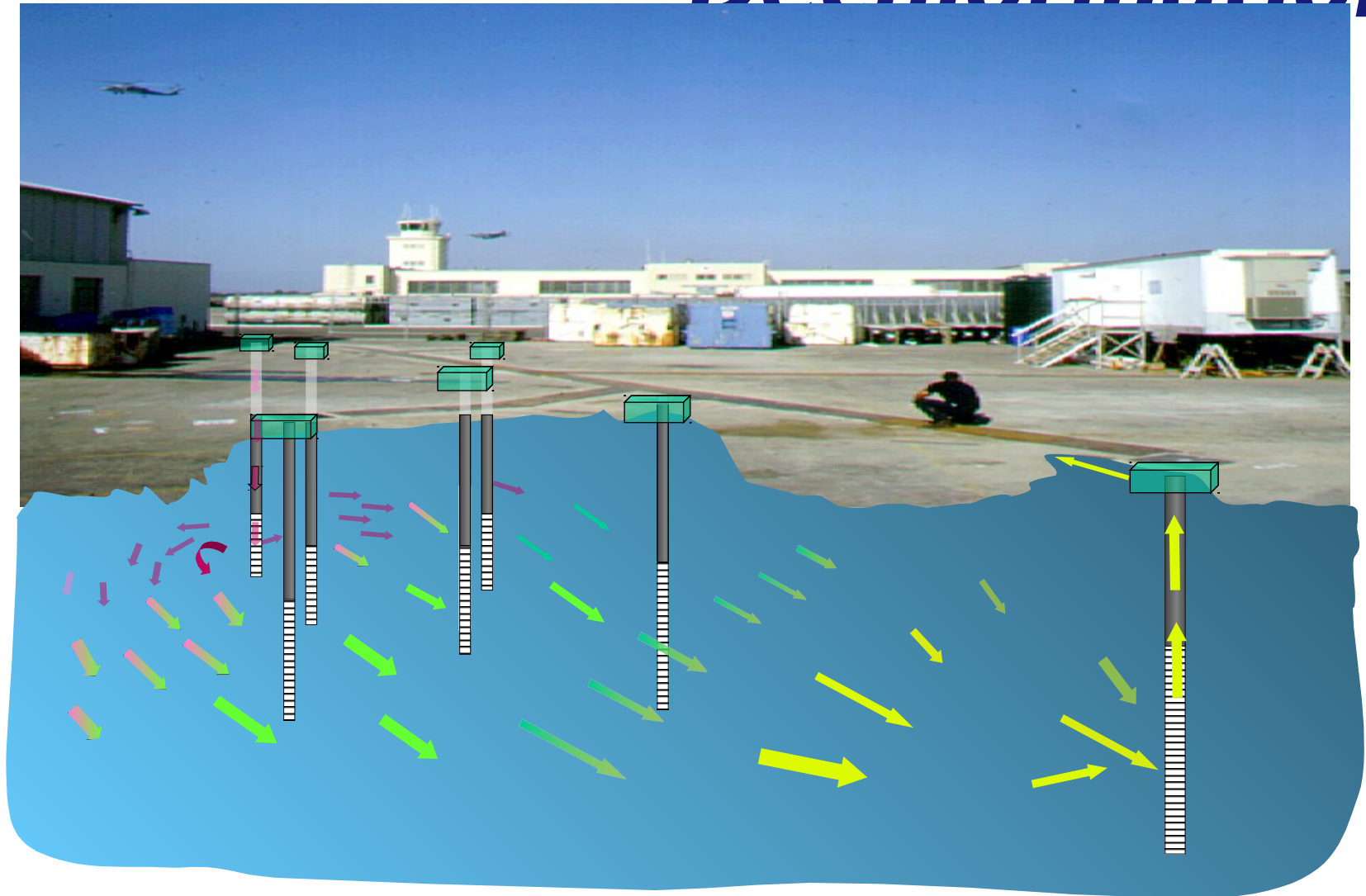
Anaerobic Dechlorination





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Anaerobic Dechlorination





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EISB Benefits to the

~~DOD~~

- ◆ **TCE and PCE are the first and the third most commonly detected contaminants**
- ◆ **Air Force - 860 TCE-contaminated sites, Navy has 450 PCE, TCE, DCE sites**
- ◆ **Improved decision making capability**
- ◆ **Enhance end user acceptability**
- ◆ **Cost avoidance**
- ◆ **Complement existing DOD, SERDP, and ESTCP funded projects**



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Objectives

- ◆ **To assess the current state of the art for anaerobic dechlorination technologies**
- ◆ **To understand site conditions and technology approaches that will lead to successful reductive dechlorination of chlorinated solvents**
- ◆ **To prepare a Technology Status Review document that compares alternative approaches to reductive dechlorination**
- ◆ **Prepare a Joint Guidance Document that RPM's can be used to compare alternative approaches**



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Project Description

- ♦ **Phase 1 Information Gathering**
 - ♦ **Interim Site Survey Report (Navy/ESTCP)**
- ♦ **Phase 2 Joint Development of Guidance Document (AFCEE)**
 - ♦ **Outline of Joint Document**
 - ♦ **2 Day Meeting (Salt Lake City, UT)**
 - ♦ **Appendix for each substrate**
- ♦ **Assemble Joint Guidance Document (Tri-Service/ESTCP)**



Information Collected for 93 sites:

- ◆ Type of substrate
- ◆ Form of matrix
- ◆ Cost of substrate
- ◆ Effectiveness of substrate
- ◆ Application technique
- ◆ Aggressiveness of treatment
- ◆ Regulatory considerations
- ◆ Life cycle costs



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Phase I - Progress to ~~Date~~

Substrate Type	#of Sites	Pilot Scale	Full Scale
DISSOLVED SUBSTRATES			
Lactate	14	11	3
Butyrate	3	3	0
Molasses	15	9	9
Fructose	1	1	0
Lactose	1	0	1
Acetate	3	3	0
Methanol/Acetate	2	2	0
Sodium Benzoate	1	1	0
Ethanol	1	1	0
SEMI- OR SLOWLY-SOLUBLE SUBSTRATES			
HRC™	35	25	11
Edible Oils	10	9	3
SOLID SUBSTRATES			
Bark Mulch	3	2	3
Chitin	1	1	0
HYDROGEN			
Direct Hydrogen Injection	3	3	0

Enhanced Bioremediation: Altus

~~AFB OU-1 Biowall~~

4,000 ft TCL/DC2 plume

■ Most common responses:

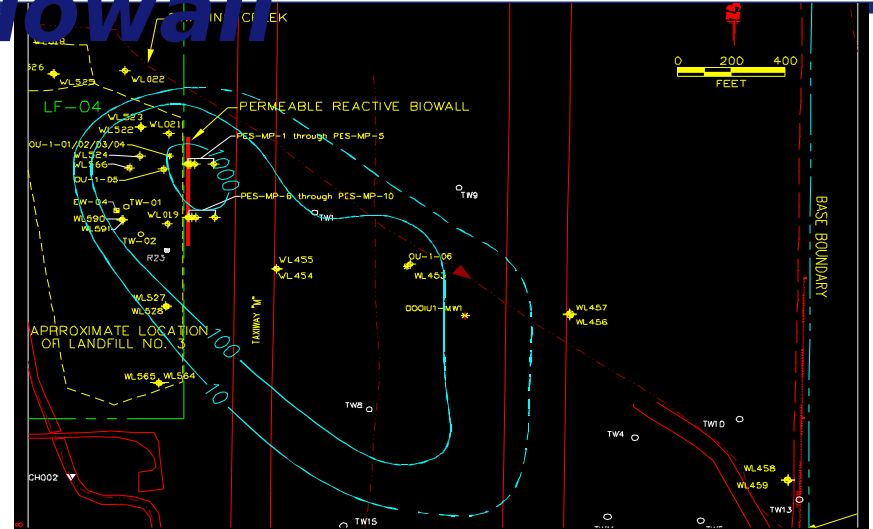
- Pump and Treat
- Fe Permeable reactive barrier
- Landfill Cap
- MNA

■ Recycled Christmas Trees!

- AF / City of Altus Partnership
- Free low-cost carbon
- Permeable reactive barrier
- \$87K construction costs

■ Results: 8 ppm $\rightarrow$ 1 ppb (4 planned)

- \$7-10M cost avoidance!





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Cost Savings

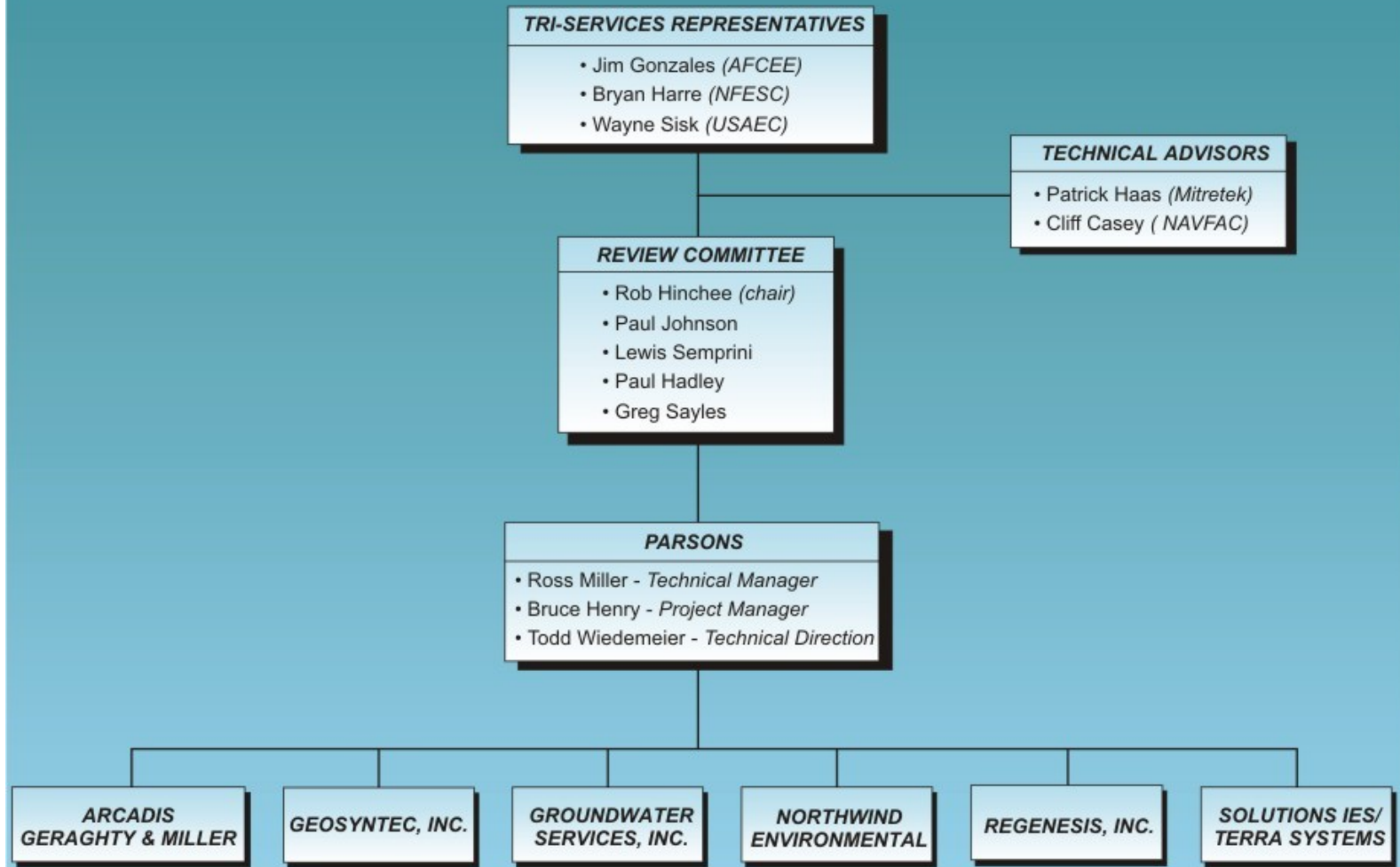
- ◆ **750 sites DOD**
- ◆ **100,000lb electron donor**
- ◆ **\$4-\$1 cost differential for electron donor**
- ◆ **10% of sites implement**
 - ◆ **Cost savings estimated at \$20 million**



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Phase 2 Organizational Chart

PRINCIPLES AND PRACTICES OF ENHANCED ANAEROBIC BIOREMEDIATION





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Phase 2 Plans

Joint Guidance Manual will have sections on:

- ◆ **State of the practice**
- ◆ **Site and technology selection criteria**
- ◆ **Microbial issues**
- ◆ **Mixing and delivery issues**
- ◆ **System monitoring and performance validation**



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Project Milestones

Phase 1 Information Gathering Complete

Phase 2 Joint Guidance Document

- ◆ **Draft Due (Review Committee, AFCEE, NFESC, ESTCP) April 2003**
- ◆ **Draft Comment/Response Period Ends: June 2003**
- ◆ **Review Meeting: Late June 2003**
- ◆ **Final Revisions Due to Review Committee: August 2003**
- ◆ **Final Document Submittal: September 2003**



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Summary

- ◆ **Final Interim Site Survey
Report**

**Delivered to ESTCP October,
2002**

- ◆ **Final Joint Guidance Manual**

**Delivered to ESTCP October,
2003**



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